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creased and decreased sensibility, can be better explained by conceiving the source of pain in the gray substance of the cord.

As Goldscheider suggested, one may laugh at the idea of the pain of an ingrowing nail being located in the cord, yet the sensory nerve fibre which passes from the toe to the posterior root of the cord, is simply the prolongation of a nerve cell situated in the posterior horn, a structure which acts as a unit. Everybody knows how frequently a disturbance of the stomach may produce pains in the head.

It seems rather unfortunate to be forced to make so much of the nerves of common feeling, nerves which are almost as vague and indefinite as the hypothetical pain nerves. They seem to be the scapegoat for all excitations which can not be accounted for through the nerves already known.

To the writer the distinction between real, direct pain produced by artificial stimulation, local inflammation, neuralgia, etc., and the general pains of discomfort, caused by disturbed nutrition or circulation and general change of nervous functioning, etc., seems to be an important one. The real pains seem a totally disparate sensation. This view would harmonize with the manner of their production in the gray substance as well as agree with their separation in time from touch and other sensations on the way to the sensorium. Real pain cannot be said to belong to the higher senses—sight, hearing, smell, taste,—and cannot properly be treated as the opposite of pleasure. The pains of discomfort, on the other hand, seem to me to be fairly the opposite of pleasure, and properly considered as the feeling-tone of the sensation. They belong to all sensations, and are made up from the complex half-unconscious sensational and ideational elements brought to consciousness along with the sensation.

Both pleasure and the pain of discomfort are general, diffused and complex in their nature, while real pain is definite, generally well localized, and simple. Attention and association, as well as the mental and bodily states, play here an important rôle, and the theories making pleasure and pain in this sense opposite *qualia* of a sensation may not be far wrong.

G. W. A. LUCKEY.

II. NEUROLOGICAL.

C. F. HODGE, PH. D.

The Growth of the Brain. A Study of the Nervous System in Relation to Education. HENRY HERBERT DONALDSON. The Contemporary Science Series. Walter Scott, London, 1895, pp. 374, 77 illustrations and 64 tables.

But a single trial is allotted to each to develop a "sound mind in a sound body." A realization that to the attainment of this end some knowledge of the laws governing the growth of by far the most important organ concerned, the brain, might be of service, has been rapidly dawning, and the present book has been awaited by a goodly audience who are interested in the problem of highest development. Physicians, teachers and parents, whose needs, as stated in the preface, the author has in view, certainly form a large proportion of society.

No book in any language attempts to cover the field as this one does. What Exner's "*Entwurf zu einer physiologischen Erklärung*

der psychischen Erscheinungen" does for the individual with regard to certain types of psychic activity, Donaldson would do for the larger problems of individual development, bodily, mental and cerebral, for differences between individuals, on their physical and mental sides, and for the development of differences of sex, race and civilization. Psychic differences between individuals and races seem to be vast. To what in the brain, especially, and in the body, generally, can these be correlated? To what degree is it possible to control, during periods of growth, the development of the physical *basis* in such wise as to raise the individual to a higher level? The book tries to answer these questions, not with vagaries, theories, or superficial platitudes, but with all the well authenticated facts of neurological science up to date.

In beginning with the egg cell and devoting three chapters to the growth of the body and its single organs, the book may remind some of a certain history of New York, which begins with the creation of the world. But in this connection it must be remembered that any discussion of the brain, apart from its relations to the other organs, is misleading in the extreme, and the emphasis which this treatment gives to the point is valuable and timely. Throughout the book, in fact, everything is referred back to the cell as ultimate unit of structure and function. This is in line with the newest physiology (Verworn, 1895), and gives a feeling to start with of beginning with a solid foundation. In these chapters the brain is compared with other organs as to initial size and relative growth, and the fact of interest to theories of education is emphasized, viz.: that of precocious development of the central nervous system. At birth the brain is by far the largest organ in the body. At the ages of seven for girls and nine for boys, it attains practically its full growth. The percentage of brain to body-weight at birth is 12.81, and the more rapid proportional growth of the body lowers this percentage to 2.23 at the age of 25.

The three succeeding chapters (IV to VI) give a most convenient analysis of brain-weight. Each element from specific gravity and water content to the weight of each part for different ages, sexes and races is carefully discussed. Wherever possible, comparisons and statistics are presented in curves and tables, whose meaning can be readily grasped at a glance. All society is laid under tribute so far as available from microcephalic idiots to the most eminent men. It falls out that the latter have, on the average, somewhat larger brains than the average of the pauper and defective classes, from which our statistics are derived. In a list of forty-five eminent men, however, we note that the brains of twelve fall below the average for common men, 1,375 grammes, and four of these even fall into Topinard's class as "small," 1,250-1,001. Between the different classes of society, the well-to-do and the less favored, considerable difference in brain-weight exists in favor of the well-to-do. No statistics exist by which the brain-weight of eminent men can be directly compared with their neighbors of similar social standing. Hence, the author is compelled to leave us in a condition of "healthy skepticism" as to the main question whether brain-weight has any definite relation to intellectual power.

From the side of gross anatomy the author naturally turns to a study of the structural elements, the nerve cells and fibres, discussing in turn their general characters, their development, the architecture of the adult nervous system, and the relations of structural elements to one another. The reader will find here outlined results of the most recent investigations stated in concise form and well illustrated, but the details are too numerous to follow in a review of

reasonable limits. No dogmatism is indulged in, and each view is allowed to stand on its own merits where difference of opinion exists among authorities. With regard to the question of continuity or contiguity of processes, the balance of present evidence is struck in favor of the contiguity theory. To the fissuration of the cortex as an index of intelligence is given no support, and none to the "criminal type."

Chapters XIII to XVII are devoted to treating the functional side of the problem. A fair statement of localization of function is first made; then the general physiology and physiological rhythms of the nervous system are treated, and continuing with a chapter on "Fatigue," the section closes appropriately with a discussion of changes occurring in old age. The topic of sleep is handled in a helpful manner, and the fact of its great importance, not only as to amount, but also as to the length of sleep periods, is discussed. Recent experiments have proved that "continuous loss of sleep is far more rapidly fatal than starvation, and the final changes are very marked, especially in the nervous system." In old age the brain decreases somewhat in size with the general decline of bodily vigor. According to the curves (p. 325) which the author derives from the statistics, this decline in weight is seen to begin for women at about forty-five, for men at fifty-five, and for eminent men as late as sixty-five. This is not so interpreted as to furnish support for any large generalization, since the data for comparison with a similar number of well-to-do though not eminent men are entirely lacking. A short paragraph, giving the author's conclusions from present evidence, is as follows: "The old age of the central system is in a measure independent of the degree to which it is exercised, unless the exercise be so excessive as to cause continual and extreme exhaustion. So far as known, the lumbar enlargement of the sedentary student does not grow old faster than that of the professional runner, and on the other hand there is no evidence to show that the best exercise of the hemispheres does clearly postpone in them the involutionary processes."

This closes what may be termed the practical part of the book, as distinguished from the two brief concluding chapters, which review the chief facts in their theoretical relations. Before going on to these a few points with regard to the preceding chapters may be noticed. Within the brief space of these chapters we have the essence of the best work of nearly 200 specialists. Scattered as it is through the literature of several languages, it has been a labor of years to bring the data together. More than this, methods of different investigators have varied to such an extent that their results, however good, have not been comparable. The author has spared no pains in working all these results over to a uniform comparable statement, expressing all relations of number and quantity in terms of the metric system. Where page after page of tables occur in the original, he has condensed the whole, wherever possible, into the form of curves, whose meaning is obvious. At points where the work of others has proved faulty, especially in matters relating to brain-weights, Donaldson has been enabled, from results of his own researches, to make important corrections. The author is primarily an anatomist and statistician; wherever possible every series of facts is expressed in clearest possible mathematical terms. This will make the book exceedingly valuable to specialists for reference, because in many instances results are stated much more clearly than in the original paper. A further service has been rendered by the author in the way in which he has effected the total separation of the facts each investiga-

tor has contributed from the prejudices and opinions which he may have entertained at the time. Thus far it is a book of facts and details, well authenticated, and entirely free from all personal coloring. Each table, each figure and every authoritative statement is given its exact reference to authors concerned; and complete indexes of both authors and subjects make it easy to ascertain exactly what an author says upon any desired topic. In all these matters of detail, which really determine whether a book is usable or not, the volume leaves nothing to be desired.

The two concluding chapters on "The Education of the Nervous System" and "The Wider View" bring the main facts of neurology into relation: the one to matters of individual education and development, the last to problems of history, race and civilization. The first fact to receive emphasis is that of the precocious growth of the brain. "Long before birth all the cells destined to compose it are already formed," though all have not developed the connections and relations of maturity. And so rapid is its growth after birth and before "formal education" has begun that the author is warranted in concluding that "the act of living is thus the most important natural education process with which the human body has to do." Thus, throughout the argument, the tendency is strong to limit the efficacy of "formal education" and emphasize the importance of natural endowment. "Nurture is of much less importance than nature." It will doubtless appear to many that the anatomical side is given undue prominence in determining the career of a man. For example, in speaking of Venn's observations upon the size of head of Cambridge students, which show that on the average successful men have larger heads than others, the author remarks: "The accomplishments of this fortunate group are therefore to be associated with innate capacities, and have small ethical significance; they may be admirable, just as are the paces of a well-bred colt, but the colt deserves no credit for his gait." It hardly seems that the data furnished actually prove the innateness of these "capacities." May they not have been wholly determined by controllable circumstances, both pre-natal and post-natal? The physiological side, scope for free play of unfolding powers, questions of food, general home nurture, habits, attacks of serious illness, even formal training, form a vast background of causes between birth and the beginning of Venn's observations. Until all these have been thoroughly analyzed by modern scientific child study, it would seem, to say the least, premature to settle down upon the cold-blooded anatomical explanation. If fate by an iron-handed disposition of nerve cells has predetermined the future of an individual, why attempt to do anything? At any rate the anatomical explanation should not be entertained until every possibility of the physiological has been exhausted. It is certainly a far more open hypothesis to suppose that function determines form rather than that anatomical structure is the prime factor. The author's view is not, however, wholly unmitigated. As he expresses it in another place, "while it must fail to produce fundamental changes in nervous organization, education may to some extent strengthen by way of exercise structures already formed, and also awaken into activity dormant cells." This view carried out to its logical consequences and applied to the whole of life would amount to the physiological explanation. Throughout the chapter, however, the anatomical argument receives all the emphasis.

The problem in "The Wider View" is that of education in its most general form. How is the individual to make the best use of his own limited life-cycle while keeping in mind the responsibilities

of the individual to the race? All the data at our command conspire to prove that civilization has had little or no influence upon size, form or structure of the brain. It is true that Europeans have slightly larger brains than savages, but races exist in which the brain is large and still no progress toward civilization has been made. Disappointing as this may appear to civilized conceit, a plausible explanation for the fact lies near at hand. A savage is obliged to meet all the requirements of his life by his own efforts and his own ingenuity. By mutual interdependence and coöperation, civilized society is enabled to accomplish much more, with possibly no greater stress upon the individual. Conditions of life in a civilized community are more favorable to acquisition of knowledge; "but wisdom, as heretofore, continues to linger, and still to occupy its place as the rare performance of a balanced brain."

The best service of the author remains to be noted, viz., that of clearing the rubbish off the field, of drawing sharply the line between fact and hypothesis. Upon nearly every page he is enabled to tell us thus far our knowledge reaches, and no farther. To carry it further we must look to future observation and experiment. This is a great service indeed.

Ueber die sogenannten Granula der Nervenzellen. FRANZ NISSL.
Neurologisches Centralblatt, 1894, pp. 676-85, 781-89, 810-14.

Ueber die Nomenklatur in der Nervenzellenanatomie und ihre nächsten Ziele. FRANZ NISSL. *Ibid.*, 1895, pp. 66-75 and 104-110.

Mittheilung zur Anatomie der Nervenzellen. FRANZ NISSL. Zeitschrift für Psychiatrie, Bd. I, p. 370.

As the result of a long and patient series of investigations upon the minute structure of the nerve cell under various conditions, we have had occasion to thank the author for the perfection, at least, of two important methods for staining the nerve cell. His magenta method for staining cortex, after hardening in alcohol, gave results of great elegance, and is still useful. It has, however, been superseded by his methyl blue staining for all cases where precise granular staining is desired. This method rests primarily on the discovery of Ehrlich that methyl blue has a selective action on nerve tissue. Under Nissl's further direction it has been possible, by the aid of this selective action, to stain portions of the nerve cell protoplasm in a manner characteristic of different types. Thus, his end result is a classification of nerve cells chiefly by the granulation of their protoplasm. More exactly stated—since Nissl would have us do away altogether with the indefinite word, "granule,"—substances which have a special affinity for the stain are deposited in a characteristic manner in different parts of the cell protoplasm and in the nucleus. Thus, according to the condition of the staining, whether dense, light or medium, a cell is said to be in a "pyknomorphic," "apyknomorphic," or "parapyknomorphic" condition. Instead of classifying cells by the number or character of their processes, as has been quite generally done, Nissl would classify them by the characters of staining of nucleus and protoplasm. His classification, as far as we have it, may be briefly given as follows: 1. Cytochrome cells, nucleus not larger than that of a leucocyte and cell-body scarcely discernible, found in granular layer of cerebellar cortex and elsewhere. 2. Karyochrome cells, with nucleus larger than that of glia cells, but only traces of cell-body. Typical examples are found in the cells of the substantia gelatinosa of the spinal cord. 3. Somatochrome cells, constituting the great majority of nerve cells, are characterized by a cell-body of definite contour, which completely envelopes the nu-